Studies in Diabetes Mellitus

III: Life History of Three Persons with Labile Diabetes, and Relation of Significant Experiences in Their Lives to the Onset and Course of the Disease

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THE literature of Western medicine has contained many references to the importance of life experiences in the onset and course of diabetes mellitus since three hundred years ago when Thomas Willis remarked upon the sweet taste of the urine of his patients, and said the disease was caused by "prolonged sorrow" (26). After Claude Bernard's original studies in carbohydrate metabolism (1) the possibility of "neurogenic diabetes" was widely entertained. Since insulin was discovered, however, the idea that a degenerative, dietary, or toxic cause for diabetes would sooner or later be found has dominated medical thinking. The older attitude toward the importance of life experiences was revived in this country by Menninger, in 1935, when he pointed out the striking temporal correlation between changes in the diabetes and changes in the mental states of a number of psychotic patients (16,17). Following him there has been an increasing body of evidence to reinforce his observations. Daniels (4,5), Dunbar (6), Mirsky (20), Bruch (2,3), Fischer and Dolger (7), Halliday (9), and Rosen and Lidz (23), have described the manner in which psychologic, social, and cultural factors affect the incidence, onset, and course of the disease.

Experimental evidence of a direct relation between life situations, attitudes, and emotions of the diabetic and important changes in his metabolism has, however, been meagre until recently. In 1946 Mirsky (19) demonstrated that both hyperglycemia and glycosuria might be induced in diabetic subjects during psychiatric interviews. Meyer, Bollmeier, and Alexander (18), in 1945, reported a correlation between the urine sugar output of 2 diabetic persons and their attitudes and feelings during psychoanalysis. The present report is concerned with further investigations of important psychophysiologic relationships in diabetes.

Methods

To obtain patients for this investigation one of the authors (L. E. H.) joined the staff of the Diabetic Clinic of the New York Hospital, where he took patients who were assigned to him in rotation, with no other selection than the exclusion of those who could not speak English. However, some persons with labile diabetes and unexplained episodes of ketosis were referred to him in order that he might obtain a sufficient number of such cases, which comprise a relatively small proportion of all diabetics. Patients who were studied received the usual careful medical history and physical examination, as well as indicated laboratory and X-ray procedures. In addition, their life histories were obtained through a series of interviews lasting an hour or more, and spaced at intervals of one or two weeks over a period of six months to two years. During some interviews specific information was elicited by direct questioning, while during others an undirected, free discussion of topics introduced by the patient was carried out. Special attention was paid not only to the overt content of interviews, but also to the association and sequence of ideas, the figures of speech, characterizations, slips of the tongue, things said, and things left unsaid, by the patient. With some patients dream material was discussed, and associations to the material were observed. As time passed and a close relation grew up between patient and physician, the patient's characteristic behavior in this relationship was observed. Likewise, his reaction to the events of his daily life was observed, while parallel observations upon the course of his diabetes were made. Information was also elicited from relatives and friends. Social service investigations were instituted in cases in which such studies seemed relevant. Psychometric tests were made when they seemed indicated. A detailed description of the methods used in the laboratory investigations is available elsewhere (10).

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Findings

Three cases from the group of persons with labile diabetes have been selected for description because they illustrate the results of both the psychologic and biochemical investigations in this study.

Case U (See Figs. 1-3).

This 21-year-old girl was referred to the investigator because of recurrent unexplained episodes of ketonuria and polyuria.

Life History: The patient was the youngest child of a second-generation German Catholic truck driver, and his second-generation Irish-Catholic wife.

Her father was an uneducated, unambitious, and easy-going man, who deferred to his wife. Her mother dominated the family. She was a rigid, meticulous woman who was easily upset by departures from routine. She was unaffectionate and often argumentative.

The patient described herself as "the baby of the family." She had a sister eight years older, and a brother six years older. Two maternal cousins have diabetes mellitus.

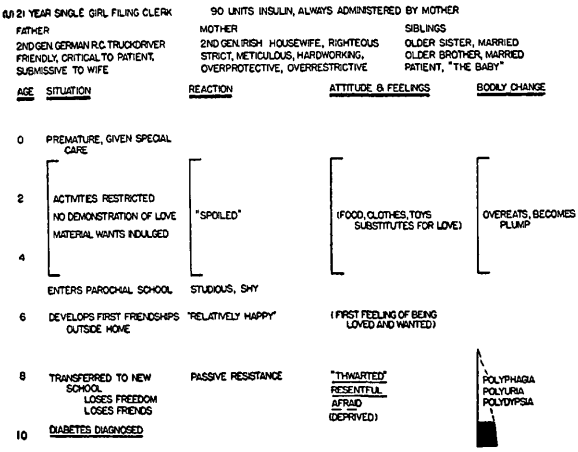

Fig. 1—Case U. Life chart from age 0 to 10.*

She was born at full term after an uneventful pregnancy, but weighed only five pounds and was called "premature." Her mother "was always worried about her." During the first ten days of life she was breast fed, but thereafter bottle feeding was begun. The baby nursed vigorously and was known as "a good eater." Development was otherwise uneventful. The patient says, "As far back as I can remember I liked to eat. I always ate a lot. Especially when I am nervous or sad I just can't stop myself from eating. I always used to like candy so much my family used to talk about it."

The patient's earliest memories indicate that her mother never gave outward evidence of loving her as much as she would have liked, but manifested her approval by giving her special foods, and buying her candy and clothes.

If she did not receive the food and toys which she demanded, she had outbursts of temper. Her sister and father felt that she was too close to her mother, and "spoiled." Her mother, who was extremely anxious and protective toward her, did not allow her to go out alone or to play with other children, and expressed great concern that something might happen to her.

* *Explanation of the Diagrams:* In the diagrams of the life histories, the age of the patient is in the first column and the significant events of his daily life are listed under *situation* in the second column. In the third column, under *reaction* are described the overt behavioral reactions of the patient at the time, as observed by relatives and remembered by the patient. In the fourth column, under *attitudes and feelings* are described the inner reactions of the patient to his life situation. Those reactions underlined in solid lines are those of which he was quite aware and easily recalled; those underlined with dotted lines are those of which he was less aware, put into words reluctantly, and admitted only in periods of confidence; those enclosed in parentheses are those of which the patient was unaware—they represent the inferences by the physician drawn from the patient's dreams, associations, figures of speech, behavior, etc., and in this sense they more or less represent his "unconscious" or "repressed" attitudes and feelings. In the last column are described the somatic changes which occurred at the same time as the events and attitudes in the previous columns. The width of the wavy black column representing diabetes is intended as a rough indicator of the severity of the disease as estimated from the amount of insulin required to prevent symptoms. Insulin dosages as represented by the squared black column are likewise not exact, but represent approximations, for reasons which are explained in the text. Arrows indicate episodes of ketosis or coma requiring hospital admission.

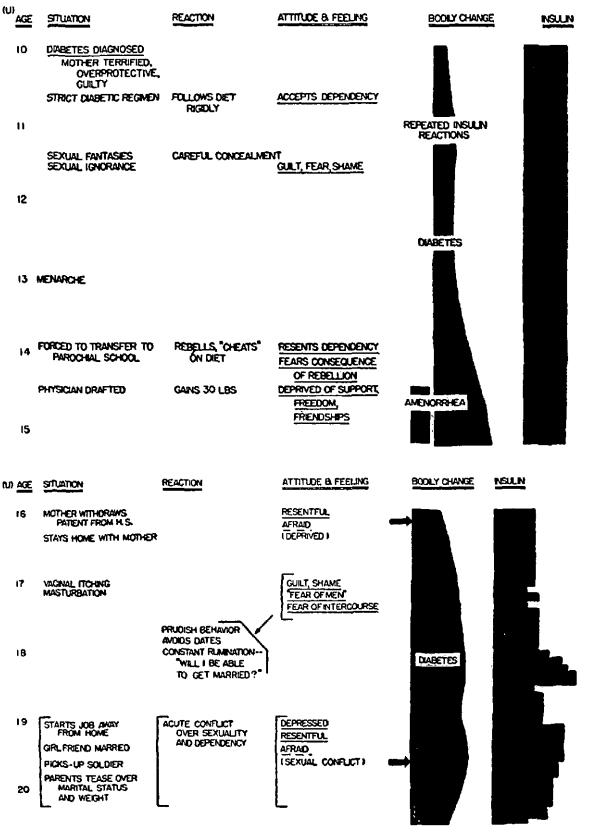

Fig. 2—Case U. Life chart from age 10 to 15.

Fig. 3—Case U. Life chart from age 15 to 20.

At the age of 5, the patient was a shy, obedient, plump little girl who clung closely to her mother. In school she began to develop her first friendships and freedom from parental restriction. Her greatest satisfaction there came from her friends and her freedom to play. During her eighth and ninth years she heard a good deal of sexual talk among her schoolmates, to which she listened with curiosity and concealed pleasure. She immediately recognized this sexual talk as "bad," but came to identify sex talk and sexual fantasy with "fun" and "friends."

In the summer of her ninth year when her family moved to a new part of town, she felt an acute sense of loss. In the new neighborhood she had only the companionship of her mother, and her mother's restrictions. She missed her friends, and was "afraid of what would happen" at the new school. For the ensuing weeks she felt resentful, hopeless, lonely, and a little fearful. Thirst, polyuria, and weight loss were first noted at this time. Diabetes mellitus was discovered several months later.

Her mother reacted to the diagnosis with guilt and fear. She increased her restrictions upon her daughter, and refused to allow her to go out alone. A measured diet was prescribed, which the mother prepared with great care. She watched the girl constantly, impressing upon her the danger of "breaking the diet." She expressed extreme concern over the most minor evidence of illness. In an attempt to keep the girl's urine free from sugar her doctor prescribed 23 units of regular insulin before breakfast, 20 units before lunch, and 16 units before dinner. Each injection was an ordeal for her. She said, "I hate needles. I always have and I always will. I wouldn't take them at all if my mother didn't give them to me."

The knowledge that she had diabetes meant to her

that she was different from other girls. She had an underlying feeling that it was somehow her fault that she had the disease, and that if she were good and took care of herself she might get well. During the first four years of her illness she tried faithfully to follow the diet. Within this period she had a "great many insulin reactions," during "at least fifty" of which she lost consciousness. Even the slightest physical exertion made her "nervous, sweaty and faint." Her mother became even more worried, solicitous and restrictive.

During her eleventh and twelfth years she gradually developed friendships at the new school, and once more began to take an interest in the sexual talk of girls and boys. She developed a rich sexual fantasy life which she concealed with utmost care, considering it extremely wicked. She decided that she could never bring herself to have intercourse with a man. The onset of her menses did not surprise her, but she did not discuss the matter with her mother who considered all talk of sex taboo.

As time passed she decided that the restrictions upon her diet and activity were too much to put up with, and began to feel that she would "miss all of the fun in life." These thoughts only increased her feelings of guilt. When she was 14, her mother transferred her to another school. At about the same time her physician was called into military service. He was a kindly and understanding man to whom she had become attached, and whose advice and urging had been a major factor in enabling her to follow her difficult regimen. Her rebellion welled up when he left. She refused to see another physician. She began to depart from her diet, at first by surreptitiously eating candy and cake at school, and later by openly flouting the diet at home. Her mother's opposition to this resulted in "making me more sad and hopeless than ever." Within a few months she gained thirty pounds, and became quite obese. Nevertheless, she felt more comfortable in the absence of insulin reactions. After this episode she had amenorrhea for a year and a half.

For two years there was constant conflict between mother and daughter. Each willful disregard of diet on the girl's part aroused great anxiety in the mother, but such rebellions also aroused great anxiety and guilt in the patient. After each one she would "be good, closer to mother than ever," and her mother would buy her new clothes. When she was 16 her mother decided to withdraw her from school altogether because it "was too much for her." Her feelings of resentment, deprivation, and hopelessness became intense. In a fit of rebellion she left home and went to a beach with two girl friends where she spent the day drinking and eating things she "was not supposed to," went swimming, and spent the day with some boys. On her way home she began to feel ill. The next morning she was taken to a hospital in a coma, with an associated upper respiratory infection.

Her mother yielded to her pleading and allowed her to return to high school in the fall, but "it was too much for me, just as she said." She soon quit and decided to "stay home where mother could take care of me." She gave up social activities, but continued to eat heavily. Her heavy glycosuria caused her to have vaginal itching, which led to masturbation. Although her sexual fantasy life continued, her outward behavior became increasingly prudish. She avoided dates, began to fear that even if the opportunity of marriage ever arose, she could not bring herself to have sexual relations with a man.

Her father and her older sister increasingly critized the patient for being too tied to her mother, and the mother for being too restrictive toward her. This finally led to an open break in which the patient took her mother's side against her father and sister. The sister left home. The patient's first visit to the New York Hospital occurred shortly thereafter.

At this time there were no significant physical findings except for obesity. A liberal diet and a daily insulin dose of 30 units regular and 30 units PZI (syringe mixture) was prescribed. Her physician was able to interest her in losing weight, and after several months she began to restrict her diet voluntarily. She obtained a job in a ten-cent store which occupied her time and made her feel more contented. Here she struck up an acquaintance with a Marine whom she would meet occasionally after work. She never dared to tell her mother about him, however, or to have a "real date" with him. During this period her weight fell from 79.3 to 67.9 Kg., and her diabetes was "well controlled."

She continued to do well until the Marine left town. Thereupon she again became depressed and hopeless, and decided that she could never be loved, or overcome the handicap of her illness. She gave up her job and lived at home, letting her mother take care of her, resenting her, rebelling against her ineffectively, and submitting to her judgment and her restrictions. Within six months her weight rose to 78.9 Kg., and her insulin dosage was increased. The symptoms of her disease could not be controlled. Ketonuria frequently recurred. She was in this state at the age of 20 when she was first seen by the present investigators. Although she had had two jobs in the interim, she had given up both of them because she and her mother felt they were "too much for me." At her first interview she said, "I'm too fat to go out. It's no fun anyhow. You don't have a chance with this disease. I stay sad all the time. When I get sad I get fat. I just eat and eat all the time."

Early Course: At first the patient was suspicious, hostile, and defensive, giving little information about her personal life. As rapport was established she revealed that she had always relied upon her mother to give her her insulin. She did not know her insulin dose, or how to prepare it. It was discovered that her mother had been using the wrong type of syringe and giving her twice as much insulin as had been prescribed. Because of her obesity a diet of P 70, F 60, Cho 175 (1520 calories) had been prescribed for her. She had reported her intake most recently as P 45, F 75, Cho 120, or 1275 calories, although she was maintaining her weight, and spilling large amount of glucose in her urine. It was found

that her recorded diets had never been accurate. This was partly due to deliberate concealment on her part because she knew that her physician became irritated if he felt she were eating too much. It was also due in part to the fact that she did not really know what she ate, for a large portion of her dietary intake consisted of crackers, cookies, ice cream, candy, sandwiches, and similar food which she consumed at odd hours throughout the day. She said that she enjoyed eating, that when she felt sad or tense she had an overwhelming urge to eat which she could not control, and that she felt better when she ate.

Despite her uncontrolled diabetes of ten years' standing, the only significant abnormal finding on physical examination was obesity. Her height was 65 in., and her weight 79.4 Kg. Her eyeground and peripheral vessels showed no sclerosis. Her blood pressure was 118/84. The liver edge was not palpable below the costal margin, but the right dome of the diaphragm was elevated on chest X-ray. There was no albuminuria, but 21 urines recorded during the previous two years had shown 4 plus glycosuria, with acetone 1 plus or 2 plus in 14 of the specimens. B.M.R. was 0, blood cholesterol 407.

Observation of an episode of ketosis: During the first three months of observation her insulin intake was established at 60 units regular, and 30 units PZI in the same syringe, and was given to her by her mother each day before breakfast. No attempt was made to control her diet beyond pointing out to her the fact that a regular and frugal diet would make it easier to control her diabetes and enable her to lose weight. During this period her weight remained stable, and she had neither thirst nor polyuria, although she continued to excrete glucose in all of her urine specimens.

She then decided to take a job as a file clerk, although her mother warned her that it would "be too much for her." On the day she started work she was tense and anxious, worried about the consequences. Contact with the men in the office made her "nervous." That day she noticed that she was thirsty, and was passing more urine than usual. There was acetone in her urine that night. The following day she continued to be nervous and to have polyuria. That night she attended the wedding of a girl friend. All of her conflicting feelings about sex, marriage, and her own hopeless outlook were aroused. The next day she was depressed and resentful as well as anxious. Thirst and polyuria became more pronounced. On the fourth day, although her mother warned her not to "exert herself too much," she went for a walk downtown in an attempt to divert herself from her morbid thoughts. She met a soldier, with whom she walked and talked; but he left her when she refused "to go out" with him. Upon her return home she found that her married sister had come for dinner, bringing her husband and baby. During dinner her parents admired the baby and praised the sister, while the entire family group joined in teasing the patient about her failure to have dates, telling her she would never get married. As the meal went on she lost her appetite and began to feel nauseated. After dinner she went to bed, feeling unloved, deprived, resentful, sad, and anxious. She awoke at 3:00 A.M., passed a large amount of urine, and vomited. She continued to pass large amounts of urine throughout the night and the next morning, and vomited everything she ingested. She became increasingly drowsy, and was brought to the hospital at 4:00 P.M.

Her mother had continued to give her her usual dose of insulin every day, and did so on the morning of her admission.

On admission she was acutely ill, drowsy, and dehydrated. Her mucous membranes were dry, her breath was heavy with acetone, her face was flushed, and her respirations rapid and deep. Her temperature was 37.4, pulse 104, but other physical findings were not remarkable. Her urine was strongly positive for sugar, acetone, and diacetic acid; it contained a faint trace of albumin, but no cells or casts. W.B.C. was 32.6 thousand, with 48 per cent mature polymorphs and 19 per cent bands. Blood sugar was 364 mg. per 100 cc., blood urea nitrogen 27.9; the CO_2 combining power was 38 vol. per cent several hours after therapy had begun. Serum K was not determined until fourteen hours after therapy had begun, at which time it was 3.7 M.Eq/Liter. (normal value, 3.8—5.1 M.Eq/Liter).

Seven-hundred and sixty units of insulin subcutaneously, 4000 cc. of 5 per cent glucose in 0.9 per cent saline, and 500 cc. of M/6 sodium lactate intravenously, and 900 cc. of orange juice and 350 cc. of salt broth orally were administered to her over the course of 18 hours before ketones and glucose had cleared from her urine. Thereafter her W.B.C. fell to 9.8 thousand, her chest X-ray was negative, urine culture showed corynebacterium (considered a contaminant), stools were negative for occult blood, ova, and parasites, and there was no fever. An electroencephalogram showed scattered 5-per-second activity, but no convulsive patterns, and a normal response to overbreathing.

She was sullen and resentful when questioned at this time. She said she felt sad and hopeless, and that nothing could be done for her. "I exerted myself too much and I have to suffer for it," she said. After discussing the events leading up to her ketosis, acetone again appeared in her urine. Transient acetonuria occurred on several other occasions during the first week of her hospital stay. On one such occasion her metabolic rate was + 23 per cent, and her blood cholesterol 168 mg. per cent. After several discussions with the physician her mood brightened perceptibly. She ceased to have ketonuria. During the last three days of her hospital stay her diabetes was controlled on 40 units of regular, 20 units of PZI mixed. After discharge from the hospital her metabolic rate was —8, with a blood cholesterol of 327 mg. per cent.

Experimental Study: After her discharge from the hospital she rapidly established a good relationship

with the investigator, and began to discuss significant matters in her personal life. One morning she came to the laboratory without breakfast, having had no

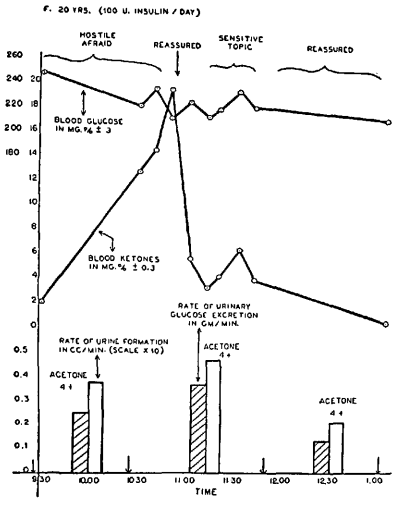

Fig. 4—Case U. Changes in blood sugar, blood ketones, urine volume, and urine sugar excretion accompanying significant personal conflict.

insulin for twenty-four hours (Fig. 4). Samples of blood and urine were obtained from her. Immediately thereafter the physician assumed a critical, domineering, and somewhat hostile attitude toward her. She gathered the impression that he considered her to be a disobedient, foolish, ungrateful girl who had brought all of her trouble upon herself by her failure to do as her mother and her physicians had told her, and by overexerting herself. Furthermore, he abruptly told her he knew all about her sexual fantasies, and that in a little while he was going to give her some "truth serum" and make her talk about them. He then left the room. For an hour she lay on the table, motionless, and saying nothing. The investigator thereupon returned, obtained a second blood and urine sample, and began an interview in a rather cold manner while inserting an intravenous drip of 0.9 per cent saline. After twenty minutes he suddenly returned to his former friendly and supportive manner, told her that he had decided not to give her the "truth serum" and pointed out that she was receiving only saline. By this time her lips were dry, she was breathing rather rapidly, there was a strong odor of acetone on her breath, she complained of thirst, and her tone of voice, gestures, and statements indicated hostility toward the physician, anxiety, and dejection. As the interviewer continued his friendly manner and she became convinced that she was not receiving a drug, she became noticeably more relaxed, secure, and friendly. The conversation was guided to the subject of her relation to her mother, at which she began to show renewed evidence of hostility and anxiety. Again the physician reassured her of his consideration and support for her, diverting her and explaining to her that a great deal could be done to secure for her the freedom and the normal life which she wished. She was left with these thoughts to wait a third hour.

At later interviews she stated that she had been intensely angry and apprehensive during the first hour. She said that she felt extremely relieved when she discovered that she would not receive amytal, that the therapist did care for her and was not going to "act like mother." The discussion of mother had aroused her conflicting feelings again briefly, but after the last part of the interview she had felt more cheerful than she did when she came in.

Her blood ketones rose to 19.6 mg. per cent (expressed as acetone recovered) during the first conflict period. Root (22) examined 41 cases of diabetic ketosis and coma and found the total ketone bodies in the blood (expressed as acetone) to be between 44 and 195 mg. per cent in all cases. It seems probable that her ketones would have reached such levels after a few hours if the conflict situation had been continued. The symptoms of ketosis were already present. The fall which occurred with resolution of the conflict was striking. A transient rise again occurred with discussion of her mother, but when she left the laboratory her ketone level had fallen to a normal level. We have described elsewhere the phenomenon of a rise in blood ketones in humans during stressful life situations (10).

During the two stress periods this girl's urine output rose to 4.7 cc./minute, and her glucose excretion rose to 376 mg./minute. Sustained urination at this rate would lead to a loss of 6760 cc. of fluid in twenty-four hours. The normal rate of urine excretion in fasting individuals without fluids is 0.25 to 1.0 cc. per minute. Because of her thirst she was given 200 cc. of water by mouth during the first and third hours, and she received 210 cc. intravenously. The three urine specimens contained 15.3, 32.3, and 11.1 Gm. of glucose respectively—a total of 58.7 Gm. The liver of a well-fed, 70 Kg. man contains about 108 Gm. of glucose as glycogen, which represents almost all of the mobilizable glycogen of the body (25). This experience therefore, apparently led to a severe drain upon her glucose stores, and probably resulted in a pronounced increase in protein breakdown for the purposes of gluconeogenesis.

Several weeks later, after the physician-patient relationship had been firmly established as a secure and protective one, she returned for a control procedure (Fig. 5). The preceding diet and activity, and all of the physical aspects of the procedure, including the fluid intake, were the same. However, on this occasion she had been told what to expect, and she felt relatively relaxed and secure throughout the procedure. The physician's attitude was calm, protective, and unchang-

ing, and no sensitive topics were brought up for discussion. No significant changes in the blood ketones took place. The ingestion of fluids led to a gradual rise in urine output, but the intense polyuria and glycosuria seen during the first two hours of the stress procedure did not occur on this occasion.

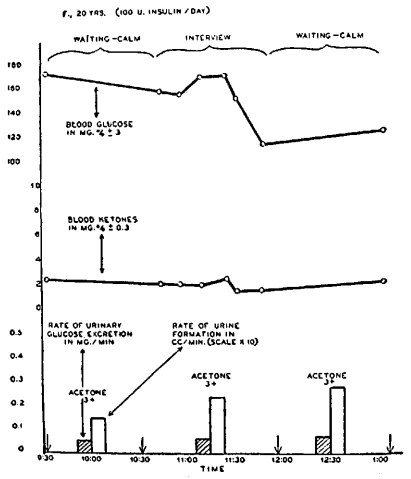

Fig. 5—Case U. Changes in blood glucose, blood ketones, urine volume, and urine sugar excretion during a control interview without stress. For comparison with Figure 4.

Subsequent course: When the patient first returned to her home after leaving the hospital, 130 units of insulin a day were required to prevent her from having thirst, polyuria, and ketonuria. Since she felt too insecure to go back to work, she was temporarily encouraged to accept her dependence upon her mother. As she worked out some of her hostility toward her mother her mood improved, and she began to feel less urge to eat. She voluntarily reduced her caloric intake, avoided concentrated carbohydrates, and began to eat only three small, balanced meals a day. Her weight dropped from 79.5 to 70.5 Kg. An unwieldy emotional attachment to the therapist was avoided by spacing visits at intervals of several weeks. Married love and the companionship of young men of her own age were presented to her as acceptable in the eyes of society and of her own church, while the therapist acted the part of a supporting, reliable, confidant who allowed her to express her own feelings and had confidence in her ability to care for herself. Today she is at work, and has begun to develop friendships among boys and girls of her own age. Present insulin requirement is 50 units a day. Fourteen urine specimens examined during the past year have shown no acetone and 1 plus to 2 plus glucose. She has had no symptoms during this time.

Case Z (Figs. 6–9).

This 19-year-old college student was referred to the investigator because of severe, uncontrollable diabetes, with repeated episodes of ketosis and coma.

Life History: His father, an Italian salesman, was a domineering, explosive, tactless man who expected strict obedience from his children, and made all of the important family decisions. He was proud of his strength and athletic ability, and expected his sons to be athletes.

His mother was also Italian-born, but she felt that she should share in domestic decisions. Although enterprising and resentful of her husband's attitude, she submitted to his domination without complaint "in order to keep peace in the family." She was overprotective toward her children.

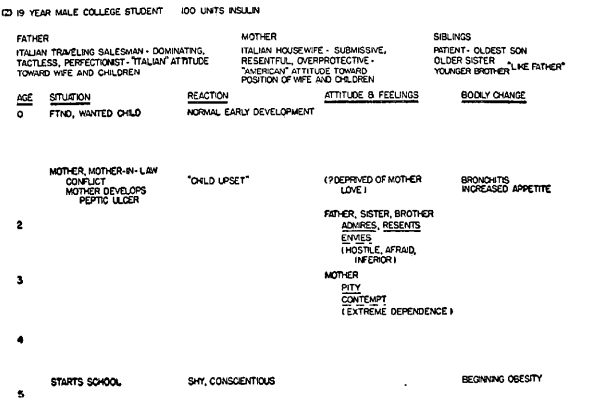

Fig. 6—Case Z. Life chart from age 0 to 5.

The patient had a sister five years older and a brother two years younger than himself; both of them had their father's outspoken expressiveness, body build, and athletic ability. There was also a sister seven years younger and a brother nine years younger.

His maternal grandmother had diabetes.

Although there had been friction in the parent's marriage from the first, it was not intense at the time of the patient's conception. The pregnancy was uneventful, delivery was at full term and normal, and the birth weight was 9 pounds.

He was breast-fed for one year, nursing uneventfully. Development was normal until the age of 14 months when in a setting of family disputes his mother developed a peptic ulcer. At this time the patient became irritable, cried frequently, and developed bronchitis.

At the age of 5 he was a shy, conscientious, obedient child. He recalls that even at this age it was "no good to speak up to my father—it only made him mad," and that "the best way to stay out of trouble was to avoid fights." He applied this passive attitude toward his school and playmates as well as at home. His father, disappointed in him, derided him, scolded him, and made fun of his lack of athletic prowess. He felt ashamed and inferior because of his lack of aggressiveness, but it seemed to him that he could not behave otherwise. His mother defended him, while his father accused her of making him into a "sissy." Throughout this period he bit his nails severely.

Whenever his father was pleased with him he gave him toys and candy. He had always liked to eat, and had "always liked sweets." During his eighth year he gradually became obese.

During his tenth year, the disagreements between his parents increased in frequency and severity. His mother had to work part-time to supplement the family income. Her ulcer symptoms recurred with great severity. The patient became concerned. "Up to then the arguments hadn't bothered me," he said. He began to fear that the family would break up. Consciously he admired his father, feeling that he was a strong, decisive and just man who would have been "all right if people had just obeyed him like they ought to." He outwardly accepted his father's criticism of him as just, because of his inferiority. "But he didn't really like it, even if he thought he did," his mother said. He "hated to see it hurt mother" when there were arguments. He comforted her, and worried about her.

Shortly after his eleventh birthday he was watching a group of older boys set fire to a pile of lumber when the owner appeared and the other boys fled. The patient, standing by innocently, was seized and beaten severely. He reacted to this incident with intense and helpless rage. He decided that being good and avoiding fights had only caused him to receive the punishment that others deserved. He resolved to be assertive and strong.

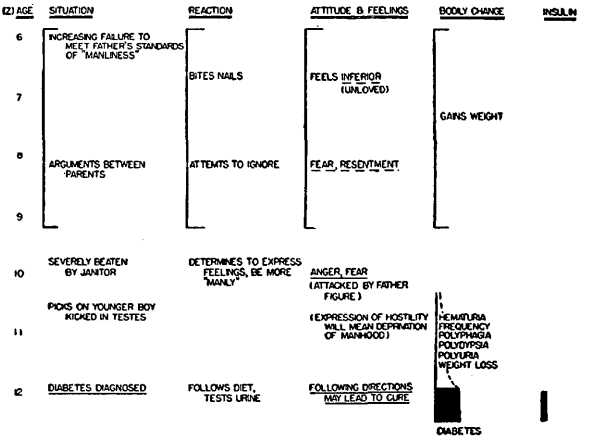

Fig. 7—Case Z. Life chart from age 6 to 12.

Shortly after this he picked a fight with a younger but somewhat larger boy who had been teasing him. The boy kicked him in the groin, and laughed at him as he lay on the ground in intense pain, humiliated, tearful, intensely angry, and unable to fight back. For a day or two following this he had gross hematuria. A urologist found him to have a contusion of the scrotum and lacerations of the urethra.

After this this the patient did not again attempt to be outwardly aggressive. He decided that his former method of dealing with life was safer. The injury to his genitalia alarmed him. It had occurred at a time when he was developing an adolescent interest in adult sexuality and was experimenting with masturbation. He feared for his future masculinity. The painful

urologic treatments increased his anxiety. The whole incident, occurring in a setting of family turmoil, made him feel dejected, hopeless, resentful, worried, and deprived of the manliness and free expression which he saw in his brother and his friends, and of the approval of his father. He became increasingly "nervous."

The symptoms and signs of his urethral injury subsided promptly except his frequency of urination. This continued despite therapy, and in the absence of abnormal urinary findings. After two months his appetite increased, and shortly thereafter his mother noticed that he was drinking a great deal of water. He began to lose weight slowly. Six months after the genital injury his diabetes mellitus was discovered.

At the time of his first New York Hospital admission he was a moderately obese boy with no significant abnormal physical findings. Skull and chest X-rays were negative, B.M.R. was −9 per cent, and blood cholesterol 188 mg. per cent. His urine contained both glucose and acetone. A psychometric examination showed an I.Q. of 116 (Stanford-Binet, L). His diabetes was easily regulated and he was discharged on a diet of P 80, F 80, Cho 250, with 12 units of regular insulin daily before breakfast.

His mother reacted to the diagnosis of diabetes with self-blame and worry. She became "sort of depressed," and was very solicitous. His father was "very unhappy" too; he began to encourage the boy, and ceased to scold and drive him so much. The patient followed the diet to the letter, and took his insulin without complaint. He said he wanted to cooperate "in order to get over the diabetes." He enjoyed being the center of family attention and the recipient of approval. His insulin requirement fell gradually to 8 units per day.

The family life proceeded in relative harmony until about nine months thereafter when the eldest sister

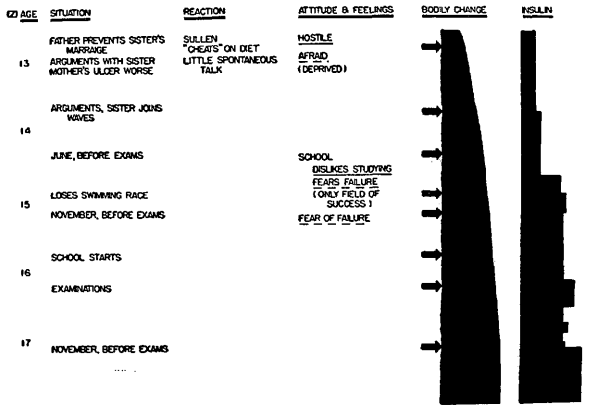

Fig. 8—Case Z. Life chart from age 12 to 17.

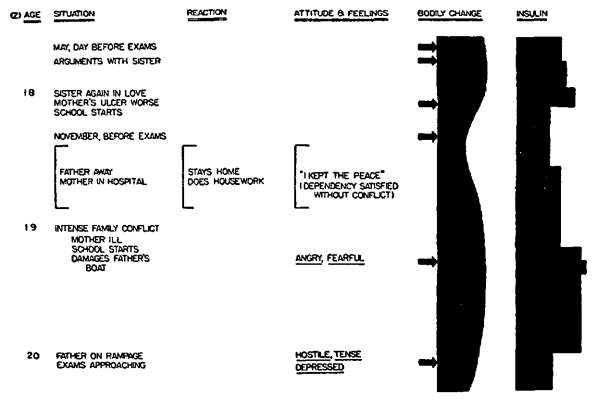

Fig. 9—Case Z. Life chart from age 18 to 20.

defied her father and announced that she had a "boy friend" whom she was going to marry. In the violent disputes which ensued the mother's ulcer symptoms reappeared. The patient, in the meanwhile, had become discouraged when his diabetes failed "to get well." He began to complain about his diet. The rift between his parents made him "sad and nervous." When he began to eat unauthorized foods his father accussed him of being a cheat and a liar.

It was noted in the clinic at this time that the patient seemed "more irritable than usual"; glycosuria had reappeared. His insulin was raised to 12 units; the physician felt that he was "cheating on the diet." The family turmoil continued. One month later his thirst, polyuria, and fatigue had returned, and he had lost 4 Kg. "despite no interval illness." His insulin dosage was raised by stages to 45 units. Despite this, his symptoms continued and he had to be admitted for regulation. On admission his temperature was 37.2° C., physical examination was not remarkable, and X-rays and laboratory tests showed no evidence of disease other than diabetes.

For a year after this he did well. The family equilibrium was restored when the sister gave in to her father's wishes. Thereafter the home was relatively peaceful until she again began to complain, and desire freedom. Once more there was violent conflict between her and her father, involving her mother. In this setting his symptoms again returned. He subsequently developed an upper respiratory infection, with acute otitis media, and was admitted to the hospital in ketosis. He was discharged on the same diet, with an insulin dose of 25 units PZI and 10 units regular.

The patient grew and matured slowly. Even his brother overtook him in weight and size, while he remained small and childish looking. This enhanced his previous feelings of inferiority. His chief source of satisfaction and reward became his schoolwork. He studied conscientiously, and began to worry continuously that he would fail his course. In June of his fourteenth year he became tense, anxious, and worried before his final examinations. His glycosuria increased and his weight fell. Ketonuria was observed on a routine clinic visit, and he was admitted to the hospital overnight for regulation.

During a relatively pleasant summer at a seashore resort he took 20 units less of regular insulin in order to prevent reactions. However, his brother and sister excelled at sports while he felt unable to take part in anything except swimming. He finally entered a swimming race but was badly defeated, and reacted with strong feelings of humiliation. He began to vomit, and after two days of vomiting he was admitted to a nearby hospital in coma.

During his sixteenth and seventeenth years he was admitted regularly to the hospital in acidosis in November and June, at the time of his scholastic examinations. On each occasion there were neither physical nor laboratory findings of significant infection or other illness. He concealed his anxiety, sleeplessness, compulsive studying, and fear of failure from the physicians who saw him. These were always associated with increased glycosuria, thirst, and weight loss.

During the summer of his eighteenth year his sister again attempted to assert her independence. Again there was conflict in the household, lasting over a period of several months. The patient tried to "reason with" his sister, but she laughed at him. His mother's ulcer became worse, and it was finally necessary to admit her to the hospital. There were two episodes of ketosis during this period. Still another admission occurred shortly after this, in November.

After his graduation from high school he had hoped to go to college. But his mother was ill, his father was away much of the time on business trips, and his brother was still in high school. The patient therefore decided that "it was up to me to help mother." He stayed at home for six months doing housework, shopping, and caring for the younger children while his brother, sister, and father carried on as usual. Although he felt some resentment toward his sister during this period, his quiet life at home, his close relationship to his mother, and relative absence of quarrels combined to make it a period of relative security and peace for him. His diabetic symptoms were few and his insulin requirement fell again.

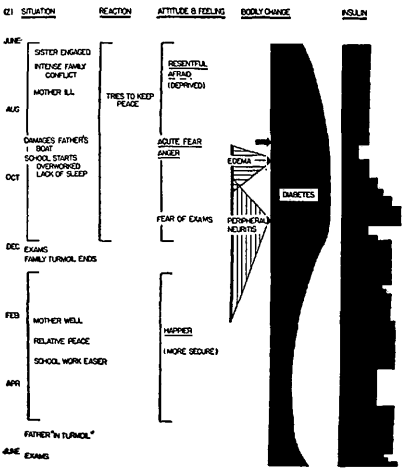

Fig. 10—Case Z. Life experiences, reactions, and course of diabetes during one year of close observation.

Course under observation (Fig. 10): In the summer of his nineteenth year this young man was again admitted to the hospital in ketosis; because no adequate precipitating cause for his irregular and uncontrollable course could be found, he was referred to the investigators for study. When first seen he was small and fresh-

faced, weighed 65 Kg., and looked as if he were about fifteen years old. His attitude was bland. He insisted that everything was quite satisfactory in his life. Only gradually did he begin to form a good relation to the physician and discuss pertinent matters.

It was found that his sister had once more attempted to break away from the home and marry a man of her choice. The usual cycle of arguments between father and daughter and father and mother had ensued. The mother had become ill. The patient had reacted as usual by "trying to keep the peace." He had become increasingly tense, restless, worried, and somewhat depressed; at the same time he had become increasingly thirsty, had passed more urine than usual, and lost weight. Three days before admission he had "borrowed" his father's power boat which he had been forbidden to use, and allowed a friend to use it. The friend had been caught in a storm, and did not return the boat to the landing until the next day. The patient had spent a night of intense worry, without sleep, fearing that the boat had been lost. He passed urine and drank water several times during the night. In the morning he was relieved to get the boat back, but spent the day frantically cleaning it in order to keep his father from noticing the effects of the storm upon it. He resented the fact that his friend would not help him in this. Just as he had this job safely completed, he found an account of the whole mishap written up in the local paper. Again he spent a sleepless night worrying about whether his father would notice the item and recognize the boat. The following day he began to vomit, and after vomiting for thirty-six hours he was brought to the hospital in ketosis. He had taken 60 units of PZI and 30 units of regular insulin separately, each morning, including the day of admission, having been on this insulin intake for several months. His food intake had been less than usual for two days, however, and during the previous twenty-four hours he had eaten nothing but salt broth and orange juice which he had vomited. He did not tell the physicians who attended him about the episode of the boat, for fear that they would tell his father.

On admission he was drowsy and lethargic, but responded to questions. His skin and mucous membranes were dry, and his eyeballs were soft. His breath had a ketotic odor. A soft, firm liver edge was felt two finger breadths below the right costal margin. There was no evidence of infection. His eyegrounds and peripheral vessels were not remarkable. Temp. was 37.2° C., pulse 76, resp. 22, blood pressure 80/60. The urine showed 4 plus tests for acetone and diacetic acids, 2 plus glucose, and a faint trace of albumin. There were no formed elements. His CO_2 combining power was 32 vol. per cent, blood glucose 106 mg. per cent, blood urea nitrogen 9 mg. per cent. W.B.C. was 8600, with 70 per cent polymorphonuclear cells and 8 per cent bands. Three-hundred and twenty-five units of insulin subcutaneously, 4000 cc. of 5 per cent glucose in physiologic saline solution, and 500 cc. of 1/6 molar sodium lactate intravenously, and 700 cc. of orange juice, water, and salt broth orally, were administered before the ketosis cleared.

After twelve days in the hospital he was discharged on a syringe mixture of 25 units of regular insulin and 15 units of PZI before breakfast, and a prescribed diet of P 100, F 75, CHO 250 Gm. He returned to his family, which was in its usual tense state; at the same time he started the fall semester in college. His concern about his school work reappeared. Glycosuria returned as soon as he got home; he voluntarily increased his insulin to 30 units of regular and 20 units of PZI. Within two weeks he began to gain weight rapidly, his face became puffy, and his ankles swollen. On return to the clinic he was found to have generalized edema, and was re-admitted to the hospital.

At the time of his re-admission the only new physical finding of significance was a generalized anasarca. His weight, which had been 60.6 Kg. three weeks before was now 69.4 Kg. His blood pressure, which had been 128/90 at the time of his previous discharge, was now 120/80. Three urine specimens showed a trace of albumin, W.B.C. 3–5, rare rbc, and no casts. His hemoglobin was 13.5 Gm., rbc 5.0 million, W.B.C. 8500, with a normal differential. B.U.N. was 16 mg. per cent, CO_2 58 vol. per cent, total protein 6.7 Gm., (albumin 5.3 Gm., globulin 1.4 Gm.), serum bilirubin 0.3 mg. per cent, bromsulfalein retention 0.8 per cent in twenty minutes, thymol turbidity 2 units, cephalin flocculation 7 units, serum cholesterol 213 mg. per cent. He excreted 80 per cent of injected phenolsulphonphthalein in thirty minutes and 98 per cent in two hours. The urine diluted to 1.000 on ingesting water; urea clearance was 92.4 per cent of maximal during the first collection period and 73.5 per cent of standard clearance during the second. Congo red test showed 90 per cent dye in the serum and 10 per cent taken up. Retrograde pyelograms showed mild bilateral pyelectasis, with probable slight obstruction at the ureteropelvic junction, but there was good function bilaterally and surgery was not considered necessary. This was not considered a sufficient explanation for the edema. On a 3 Gm. salt diet he lost 4.4 Kg. in five days, and his edema disappeared.

The financial strain of two hospital admissions added to the tension in his family. The difficulties with the sister continued. The time he had lost from school caused him further anxiety. He began to work harder and longer as he became increasingly tense. Each morning he arose at 6:30 A.M., had a brief breakfast, and rode for one and a half hours until he reached school. He studied and worked for eight hours at school, took the long ride home, and got back about 6:30 P.M. After helping his mother get dinner and put the younger children to bed, he studied until 1:00 A.M. or later.

As he continued this regimen he was seen to become more and more tense and anxious. He was unable to sleep; his hands began to shake; he felt "jumpy," and was unable to sit still. His appetite decreased. He began to complain of palpitations. As these symptoms progressed he developed constant thirst and polyuria. "It seems I just run from the faucet to the bathroom," he

said. His weight at the time of his discharge from the hospital was 65.6 Kg.; two weeks later it had fallen to 63 Kg., despite the fact that his insulin intake had been raised by stages to Protamine 40 units PZI and 50 units of regular insulin, daily.

As his weight fell he began to complain of burning and tingling in his feet. At the time of his last admission the only neurologic abnormality which he had shown was the absence of ankle jerks. Now he developed diminished sensory response to pin, cotton, and vibration over both feet and lower legs; and his knee jerks disappeared. His appetite continued to decrease; his total food consumption fell to 1100 calories a day, while his twenty-four-hour urine volume was as high as 4000 cc., and contained up to 250 Gm. of glucose.

The physicians, becoming alarmed, attempted to persuade him to rest, to eat an adequate diet, and to stay home under careful observation and treatment until his diabetes could be brought under control. However, he was completely unable to accept the suggestion. He insisted that "everything is all right," and was unable to stop his headlong, compulsive, driving activity for even so much as one day. Even this only partly controlled his anxiety; at examination his pupils were widely dilated, his palms cold and moist, his pulse 140, he had a pronounced startle reaction, and he was unable to sit still for more than a few minutes during an interview.

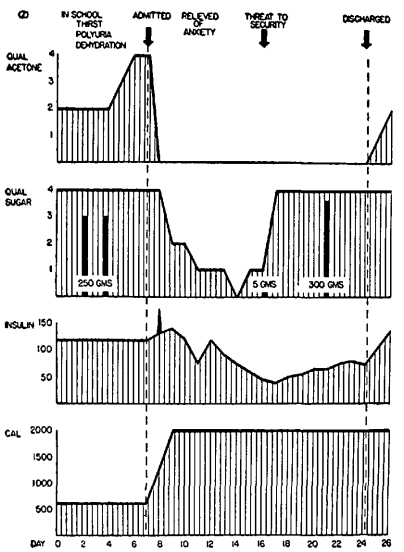

Fig. 11—Case Z. Remission of diabetes induced by removing patient from a stressful life situation. Note reappearance of symptoms when he learned that he would have to face the former situation.

Within two weeks, as the end of November approached, his weight had fallen to 57.1 Kg. His mother brought him to the hospital, against his protest, saying he was "driving himself to death, and almost starving himself." His dietary intake consisted of coffee and occasional sandwiches. He had been unable to sleep for a week. On a total dietary intake of approximately 780 calories (P 40, F 20, CHO 60), he was passing as much as 4000 cc. of urine containing 250 Gm. of glucose, although he was taking 70 units of regular insulin and 60 units of PZI each day. The nitroprusside test was strongly positive for acetonuria. The burning of his feet had become almost intolerable.

At the insistence of his mother and the physician he was admitted to the hospital (see Fig. 11). At the time of admission his temperature was 37.2° C, his blood pressure 130/80, and except for the neurologic abnormalities mentioned and the hepatomegaly previously described, there were no other abnormalities. His urine contained a faint trace of albumin, but no cells or casts. His W.B.C. was 6500, with 38 per cent mature polymorphonuclear cells and 19 per cent band forms. His chest was clear on fluoroscopy. His stool contained no ova or parasites. His B.M.R. was −4 per cent. An electroencephalogram showed a normal record. His cerebrospinal fluid showed no abnormality except a slightly elevated protein (87 mg. per cent).

Once he was admitted to the ward steps were taken to alleviate his anxiety. His parents, worried about him, forgot their differences temporarily and united in showing attention to him. Arrangements were made with his school to excuse him from examinations and at the same time give him credit for his semester's work. Although his diet was set at 2100 calories (P 100, F 100, CHO 200), both glycosuria and ketonuria rapidly disappeared. Within ten days his insulin requirement fell to 40 units.

On the eleventh hospital day he suddenly discovered that he would have to take his examinations after all. Although his diet and activity were not changed, glycosuria promptly reappeared, and he become noticeably more tense. At the time of his discharge his insulin requirement had risen to 80 units.

After his discharge his insulin requirement rose gradually to 120 units each day. An attempt was made, with the cooperation of his family, to get him a room at college, away from his home. He stayed in it only one week before returning to his parents and to his former pattern of activity. However, his father and sister had composed their differences, his mother was in better health, and the household was altogether more tranquil. Although he was seen only occasionally by the physician, it was possible to keep him symptom free and to maintain his weight on his prescribed insulin dose. Over the course of three months his neuropathic symptoms disappeared. There were no further serious episodes of ketosis until the following June, when he telephoned the physician and said, "Doc, I'm sick and vomiting. My father is on a rampage, and I'm going to have my first exam tomorrow." This episode of

ketosis was controlled by treatment overnight in the emergency ward.

Short Term Experimental Observation: During his hospital admission, at a time when his insulin requirement had fallen to 40 units, a catheter was inserted into his hepatic vein from which blood samples were obtained during an interview. Fig. 12 is a graph of the ketone and glucose content of serial samples obtained during a period of two hours.

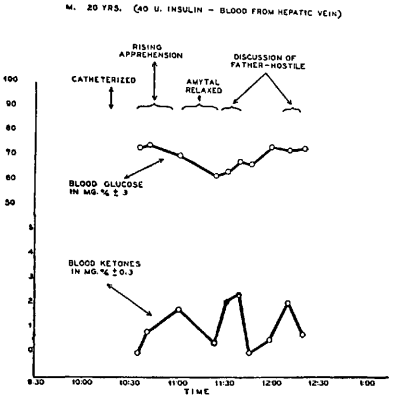

Fig. 12—Case Z. Changes in ketone concentrations in hepatic venous blood during discussion of topics of significant conflict. Study made during the period of remission while patient was in the hospital.

The first blood sample contained less than 0.2 mg. per cent of ketones. Shortly thereafter he began to show some apprehension and resentment toward the procedure, which increased when the interviewer implied a question about his manliness; at this time his blood ketone level rose to 1.8 mg. per cent. He was thereupon given 0.5 Gm. of sodium amytal intravenously, accompanied by a solicitous attitude and reassuring suggestions. He became quite drowsy and relaxed. After twenty minutes of such relaxation his blood ketone level had fallen to 0.5 mg. per cent. A discussion of his father and the episode of the borrowed boat was then begun in an abrupt and unsympathetic manner, with the physician defending the father's behavior and attitude. The ketone concentration rose rapidly to 2.4 mg. per cent, while the patient showed evidence of his hostility in both the manner and the content of his speech. The physician thereupon changed his manner to a less threatening and more reassuring one, and introduced more neutral topics. Within fifteen minutes the ketone concentration had fallen to less than 0.2 mg. per cent. When topics relating to the father and the elder sister were again introduced, and evidences of hostility were again aroused in him, the ketone concentration again rose to 2.1 mg. per cent. After a final brief period of reassurance and diversion the ketone level fell to 0.8 mg. per cent, and the procedure was terminated.

Case V. (Figs. 13–15)

This 38-year-old housewife was referred to the investigator because of her exceedingly labile diabetes; despite all attempts at control she alternated rapidly between ketosis and insulin reactions.

Life History: The patient was the second daughter of a second-generation Lutheran truck-driver, of German-Dutch parentage. He was an easy-going, good-natured, unambitious man who deferred to his wife in family decisions.

(V) 38 YR. AMERICAN BORN 2ND GEN. GERMAN, DUTCH, FRENCH LUTHERAN HOUSEWIFE

FATHER	MOTHER	MOTHER-IN-LAW	OLDER SISTER
GERMAN BORN LUTHERAN TRUCK DRIVER, GOOD NATURED, EASY-GOING	2ND GEN. AMERICAN BORN GERMAN LUTHERAN HOUSEWIFE PRACTICAL, COLD, FIRM, UNAFFECTIONATE, DOMINATING	CAPRICIOUS, ARGUMENTATIVE, SUSPICIOUS, OVERPROTECTIVE TO SON, RESENTFUL OF PATIENT	"LIKE MOTHER"

AGE	SITUATION	REACTION	ATTITUDE & FEELINGS	BODILY CHANGE
0	PROLONGED, PAINFUL DELIVERY			
		NURSES VORACIOUSLY, UNSATISFIED, ALWAYS HUNGRY		
2	MOTHER STRICT, COLD, REJECTING MATERIALLY INDULGENT, SPECIAL FOODS	TEMPER TANTRUMS LIKES SWEETS	(FOOD REPRESENTS MATERNAL LOVE)	
4			TO MOTHER DEPENDENT DEPRIVED RESENTFUL OF DEPRIVATION	
	MOTHER ILL, PATIENT LIVES WITH FAVORITE GRANDMOTHER		TO FATHER LOVES	
	RETURNS HOME	TEMPER TANTRUMS	RESPONDS TO HIS AFFECTION	CONVULSIONS
6	STARTS SCHOOL	"LIKED IT" SHY DAYDREAMER OCCASIONALLY REBELLIOUS, ARGUMENTATIVE	(RESENTS HIS LACK OF SUPPORT)	

Fig. 13—Case V. Life chart from age 0 to 8.

Her mother was of second-generation French-German parentage. She was a practical woman, cold, firm, and unaffectionate. She dominated the family, and had occasional outbursts of temper.

There was no family history of diabetes.

The patient was born after a prolonged and difficult delivery. For one year she was breast fed. She nursed voraciously, biting the nipple so hard that her mother once threw her angrily across the bed. Walking and talking were not delayed.

Her earliest memories concern her mother's lack of affection for her. She says, "I was never given enough love and warmth. Maybe I attach too much importance to it. It seems I need more love than other people. I have noticed this often." The members of her family knew that if the mother wished to express affection she would go to the kitchen and prepare special food for them. "If I was a good girl she would give me cookies, and make goodies for me."

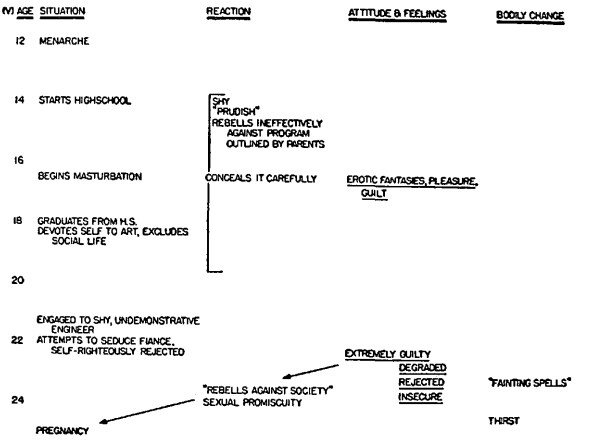

Fig. 14—Case V. Life chart from age 10 to 24.

"I always had a good appetite—always ate well—I enjoyed it. I still do. I nibble a lot. . . . When I feel alone and unloved I go and cook something pleasing to the palate."

By the time she was 3 she developed frequent and violent temper tantrums, which typically occurred at times when she was denied things she wanted. She was punished by being spanked and locked in a closet, and was regarded as "spoiled."

Her sister, four years older, was less pretty than the patient, less demanding, "more tactful," and got her way more often. The mother was partial to the sister, but the father apparently preferred the patient. But the girl felt that he could not be relied upon because he always abandoned her to her mother's wrath if she became involved in an argument. The patient became increasingly demanding and assertive, while her mother constantly rebuffed her, resisted her demands, and favored the sister. She was regarded as impulsive and heedless. When punished by being put in a closet she tore all of the clothes in it to shreds. "Nothing I did would make mother pay attention to me," she said. Nevertheless, when she was 5 she was "very close to mother." If her mother left her she became upset and cried.

Once while her mother was ill it was planned that the patient would stay with her grandmother. When the time came for her to leave home she had a temper tantrum which ended in an epileptiform convulsion. However, she became quite fond of her grandmother during the summer, for although she too was a dominating woman she was affectionate. When the time came for her to return to her mother she had another violent outburst of temper which also ended in a convulsion. Until her tenth year she spent her summers with her grandmother to whom she became strongly attached. During this period she began to feel a need to "attract the attention of older women." In school she was shy and studious, but made few friends among other children. When she was 12 she was much attracted to an older teacher "who was a motherly woman." "I had a regular crush on her."

When she went to high school her parents tried to persuade her to take a business and secretarial course, while she wished to study art and music. She began to write plays and paint in her spare time, but "Mother ridiculed my drama and made fun of my painting." The patient retaliated by failing her commercial courses. "Ever since then I have hated anything routine and clerical," she says. All through her adolescence she had frequent and violent disagreements with her parents about her future career, but when she graduated from high school at 18 she was able to have her way. She went to art school with her grandmother's assistance.

For four years she studied dancing, painting, music and sculpture, with great interest and pleasure.

Her menarche had occurred uneventfully when she was 12. After this she had many sexual fantasies and masturbated intermittently. However, she showed little interest in boys for several years. Because she was pretty she had many opportunities for dates; she enjoyed flirting and attracting boys to her, but felt no attraction to them. When she was 19 she fractured her femur in a fall, and during the long period of hospitalization the pressure of the cast against her genitalia stimulated her to frequent masturbation, to which she reacted with pleasure and guilt.

After graduation she worked and continued her art studies, to the exclusion of all social activities. During this period she had several brief homosexual experiences, without forming any firm attachments. When she was 24 a young engineer began to court her; her parents were much pleased with him. She found herself attracted to him, and decided to marry him. He felt that sexual experimentation should wait until after marriage; she thought that this was old-fashioned and unromantic. She attempted to seduce him, but he was horrified at her forwardness. He tried to punish her for her "promiscuous behavior" by not seeing her for a month. Humiliated, rejected, angry, and bitter, she awaited the day of their engagement, and then walked out of her party and refused to marry him.

Her parents, who knew nothing of the motives behind this act, were furious with her, and told her that they were "through" with her. She herself felt that she was indeed a wicked woman who had automatically separated herself from society by her acts. Accordingly she decided to play the role to the limit. Impulsively she plunged into an affair with another man, and soon found herself pregnant.

"That was the worst thing that ever happened to me." Feeling bitter, rebellious, rejected, and depressed, she became increasingly anxious and began to faint frequently. Two months later she married the man, who then told her triumphantly that he had impregnated her in order to get her to marry him. He was intelligent, but he was alcoholic, irresponsible, and unemployed. He was much attached to his mother, a domineering, critical, ill-tempered and suspicious woman, who immediately took a strong dislike for her new daughter-in-law, who was forced by economic pressure to live with her.

Throughout her pregnancy the patient became increasingly dejected, tense, and sleepless, while her mother-in-law was increasingly hostile and critical. Labor was prolonged and difficult; the child was difficult to nurse. She began to lose weight. After several months she developed fatigue, thirst, polyuria, and leg cramps. Her mother-in-law accused her of complaining in order to seek sympathy. Diabetes was diagnosed only when she was taken to a hospital in coma eight months after her symptoms had begun.

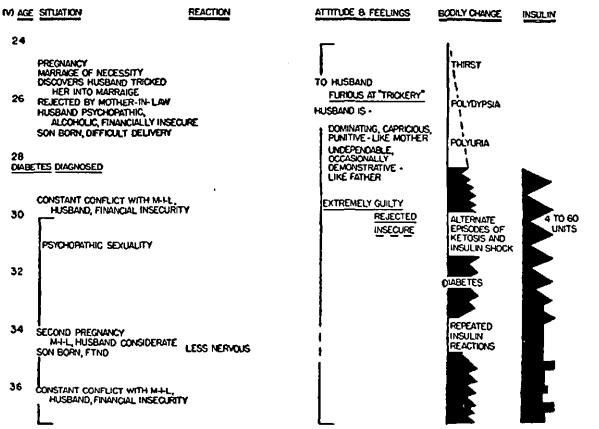

Fig. 15—Case V. Life chart from age 24 to 36.

From the first her illness was difficult to regulate. Fixed doses of insulin and fixed diets did not prevent her from having thirst, polyuria, and ketonuria on one day, and insulin reactions associated with unconsciousness on the next. Her private life was as chaotic as her diabetes. Violent arguments with her mother-in-law, and drunken abuse from her husband alternated with periods of remorse and reconciliation. Her husband would not give up his mother, and the patient felt too dependent on him to break away from her marriage.

After several months she decided to take her insulin "according to how I felt." She noticed that she "felt bad when my sugar was high, and felt good when it was low." When she felt "bad" she took more insulin, and when she felt "good" she took less. In this manner she took as little as 4 units of regular insulin on some

days, and as much as 60 units in divided doses at irregular intervals on other days. Her diet was equally irregular. She ate no fixed meals, and no fixed amount at any one meal. She avoided no foods, and often drank alcohol freely. On this regimen she felt that her symptoms were at least no worse than they had been when she followed her physician's advice. She was never ill enough to be hospitalized. During this period she observed that she almost invariably developed an insulin reaction before having sexual intercourse. "Even if I have four plus sugar in my urine, I always get an insulin reaction when I get sexually excited."

After eight years of marriage she again became pregnant. Her husband and mother-in-law were pleased by this. They became more attentive and affectionate toward her than they had ever been before, and her life became happier and less stormy. Because of frequent insulin reactions, she was brought to the New York Hospital for regulation.

At this time she was found to be underweight (ht. 156 cm., wt. 45.1 Kg)., but except for this and dental caries, there were no other abnormal physical findings. Her eyegrounds were normal, her blood pressure was 110/70, her peripheral vessels were not sclerotic, and her liver was not palpable. Her urine contained sugar, but no albumin or formed elements. She was given a 2500 calorie diet (P 100, F 100, CHO 300 prescribed) and 35 units of PZI in a single dose. Glycosuria was disregarded. On this regimen she passed through pregnancy uneventfully, bearing a 4700 Gm. infant at full term. During the later stages of pregnancy her insulin requirement gradually rose until she was receiving 50 units PZI and 20 units of regular insulin, separately, at term. After delivery her requirement fell to 40 units daily, which was given as 20 units PZI and 20 units regular, mixed. She has remained on this dose since, except for brief periods.

After the birth of her child her life returned to its former state of turmoil and insecurity; as it did so the rapid and violent fluctuations in her diabetes returned. Because of this she was referred to the investigator two years later.

Course under observation: When first seen the patient's physical and laboratory findings had not changed. She weighed 47.5 Kg. An electroencephalogram showed predominantly patterns of low amplitude fast waves, associated with muscle potential, but there were stretches of 5–7 per second waves and two outbursts of high amplitude waves, some of which contained slow waves. It was felt that this was a pathologic record consistent with a convulsive disorder of the grand mal type.

A good relation with the physician was rapidly established. It was arranged that she would keep a diary in which she set down all of the events of each day, her attitudes and feelings at the time, and ruminations or random thoughts which occurred at the same time. She also recorded everything she ate, and tested each urine specimen for glucose (Benedict's qualitative test) and for ketones ("Denco" acetone test*). Each week she and the investigator reviewed the events of the preceding seven days and her reactions to them, with special attention to the associations and memories elicited by these events.

Figures 16, 17, and 18 show sixty days of her life as recorded in the diary. In these figures glycosuria is represented by the cross-hatched areas along the bottom line. Ketonuria is represented by the black columns on the second line, their height representing intensity and their width, duration. The dots on this line represent insulin reactions. Significant events are recorded

* Manufactured by the Denver Chemical Co., New York. This is essentially a nitroprusside test, with the reagents in powdered form.

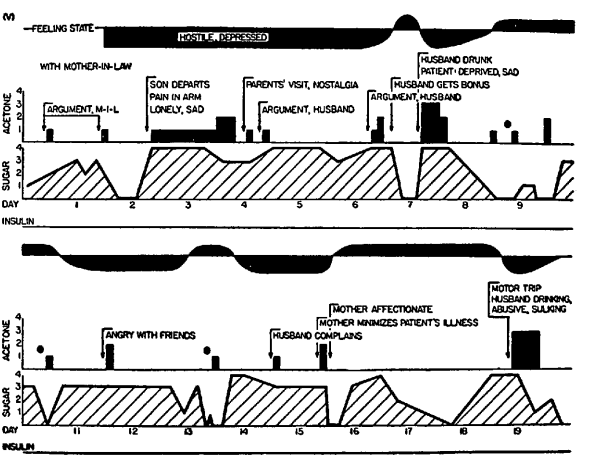

Fig. 16.—Case V. Diagram of first 19 days of observation. See text for explanation of figures.

above. The uppermost waving black line is an attempt to represent graphically the changes in the way she saw her life situation and felt about it. Swings above the base line represent periods in which she felt relatively secure and loved. Such attitudes accompanied periods when there were relatively few arguments, when her husband made love to her and her mother-in-law "paid attention" to her. At such times her mood was one of relative calm and happiness, associated with some overt anxiety; her ruminations contained much sexual fantasy, interspersed with thoughts such as "after all, my husband really does love me" and "I really am not as badly off as some people." Swings below the base line represent periods when she felt unloved and uncared for. Such attitudes accompanied periods when there were repeated arguments in the household, when her husband was drunk and abusive, and she was harried by bill collectors. At such times her mood was one of dejection, anger, and bitter resentment, with some fear but relatively less anxiety; her ruminations contained much hatred for her mother-in-law, interspersed with memories of her past misfortunes, and wishes that she could be cared for by her mother. Casual happenings at such times tended to remind her of unpleasant events

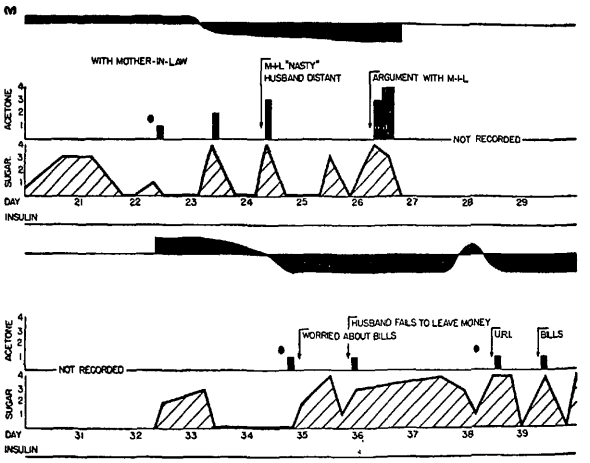

Fig. 17—Case V. Diagram of days 20 to 40 of observation period.

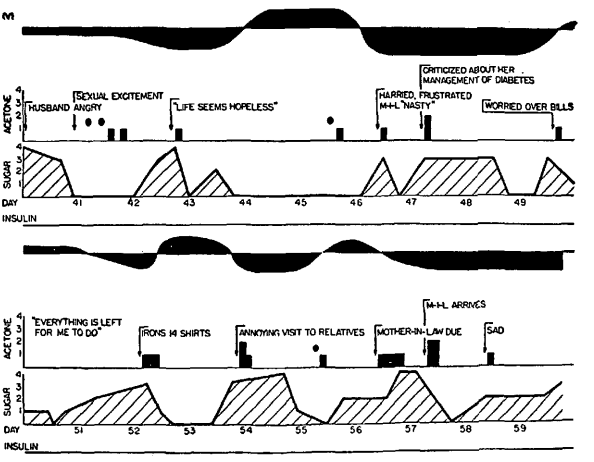

Fig. 18—Case V. Diagram of days 41 to 60 of observation period.

in her childhood, usually connected with her mother.

It will be observed that all of her insulin reactions, indicated by black circles on Figures 16, 17 and 18, occurred during the upward mood swings, and that glucose disappeared from her urine at such times. Such upward swings varied in duration, and were set in motion by a variety of events in her daily life. For example, on the seventh day her husband unexpectedly came home with a small bonus, and she was briefly happy. On the fifteenth day her mother came to visit her, and after being at first critical, she was briefly affectionate. From the twentieth to the twenty-third day she was enjoying a brief vacation in the country with her husband and mother-in-law, during which their differences were temporarily submerged. On the forty-first day her husband was affectionate and there was a great deal of sexual activity; the accompanying insulin reactions were the most severe and long-lasting seen during the period of observation. Several of the other insulin reactions accompanied sexual relations. In all instances the upward swings in attitude and feeling accompanied the periods of diminished glycosuria.

The association of glycosuria and ketonuria with periods of feeling unloved, dejected, and angry is equally striking. The day-to-day episodes which precipitated these feelings have been charted. It may be seen that arguments precipitated many of these episodes, but that such apparently trivial episodes as the arrival of bills, the departure of her son for camp, and criticism from her mother were potent stimuli because of their special meaning for her. The upper respiratory infection which she developed on the thirty-eighth day did not produce nearly so profound a metabolic effect as did her husband's drunkenness on the seventh day when he celebrated the receipt of his bonus.

Several brief episodes of ketonuria occurred after insulin reactions, at a time when there was no glycosuria, and her mood was relatively good. (Cf. days 9, 13, 22, 34, 41, and others). Somogyi (24) has pointed out that pronounced hypoglycemia may be followed by transient ketonuria. This is a part of the homeostatic response to hypoglycemia and has a different significance in the life of a diabetic from the ketonuria which occurs in association with glycosuria, polyuria, and thirst.

Throughout the period of observation her insulin intake remained constant at 40 units total, taken each morning at nine o'clock as a mixture of 20 units PZI and 20 units regular insulin, except during the first ten days when she took 20 units PZI and 18 units of regular insulin. Her dietary intake fluctuated somewhat, averaging 2100 calories distributed approximately as P 100, F 100, and CHO 200 gm. Especially during periods of dejection she ate more, "nibbling" between meals. This may have contributed to her glycosuria at such times, but cannot be considered as causing ketosis (15, 21).

Experimental observations on glucose tolerance: With the cooperation of the patient, short-term laboratory studies were undertaken. She followed a diet of 2600 calories, P 120, F 150, CHO 200, eating three regular meals and a small bedtime feeding. Her insulin intake was set at 20 units PZI, and 20 units regular insulin, separately, before breakfast, and 10 units of regular insulin before her evening meal. On the evening before each laboratory procedure she omitted the pre-dinner insulin, and she also omitted the morning insulin and breakfast on the day of the procedure. She arose at 6:30 A.M., emptied her bladder, and rode to the laboratory, arriving at 9:00 A.M. Throughout the procedures she sat quietly in a chair.

At the first procedure she was given 500 cc. of 50 per cent glucose by mouth, after initial blood and urine samples had been obtained. One-half hour later, after the second samples, she was engaged in a discussion of her insulin reactions which led to a discussion of their relation to sexual intercourse, and of sexual topics in general. During the course of this discussion she mentioned her warm feelings toward the therapist, and the fact that she had had sexual thoughts about him. After the discussion was terminated she amused herself with sexual fantasies for one-half hour. This experiment took place on a day when she was feeling relatively secure and happy, during a period of calm in her home life. The results are diagrammed in Figures 19 and 21.

The second procedure was outwardly identical. It was performed, however, on the morning after a dispute with

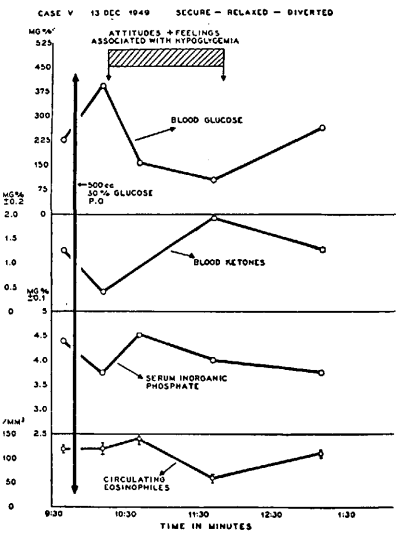

Fig. 19—Case V. Changes in blood constituents produced by ingesting 500 cc. of 50 per cent glucose solution on a day when patient felt relatively secure, cared for, and happy, and when topics usually associated with hypoglycemia were discussed.

her husband, when she was feeling unloved, dejected, and resentful. After she had received the glucose the investigator abruptly assumed a cold and unsympathetic attitude toward her. He brusquely refused to listen to her complaints about her husband. Instead he handed her a large group of file cards to arrange alphabetically, telling her that she "might as well do some work as sit around all morning." Thereafter he ostensibly ignored her except for doing venipunctures and obtaining urine specimens. As the morning passed the patient felt more and more irritated and neglected. When the experiment ended she suddenly said, "Don't you know I *hate* clerical work!" burst into tears, and ran from the room. The results of this study are diagrammed in Figures 20 and 22.

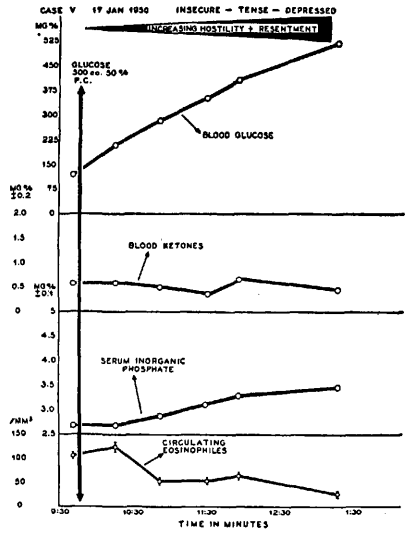

Fig. 20—Case V. Changes in blood constituents produced by ingesting 500 cc. of 50 per cent glucose solution on a day when patient felt unloved, insecure, resentful, and depressed, and when the investigator assumed a cold and inattentive atttiude toward her.

In comparing the changes in the blood constituents which took place in the two experiments, it may be seen that on the day when she felt secure, and sexual topics were discussed, the following occurred (Fig. 19):

1. Her blood glucose level, which was 223 mg. per cent fasting, rose abruptly to 380 mg. per cent one-half hour after the ingestion of glucose. When the discussion of sexual topics was begun it fell to 152 mg. per cent, within a half-hour, and it continued to fall to 104 mg. per cent as her sexual ruminations continued. After she was diverted to other topics the glucose level rose to 258 mg. per cent.

2. As the blood glucose rose, her blood ketones fell from 1.25 mg. per cent to 0.4 mg. per cent; then, as the blood glucose fell, the ketones rose to 1.9 mg. per cent.

3. The serum inorganic phosphate fell as the glucose level rose initially, suggesting an uptake of glucose by the tissues.

4. After one and one-half hours the circulating eosinophiles fell from 119±10 to 59±5 per cu. mm.

During the experiment associated with hostility, the following changes took place in the blood constituents (Fig. 20):

1. The blood glucose level rose steadily from 128 mg. per cent to 517 mg. per cent.

2. There was no significant change in blood ketones. (If the patient had been fasting and had not ingested glucose we would have expected her ketones level to rise under these circumstances.)

3. There was no fall in serum inorganic phosphate, suggesting that there was no increase in the rate at which her tissues were taking up glucose.

4. Her circulating eosinophiles fell promptly from 125±10 to 55±3 per cu. mm.

The changes in her urine output may likewise be compared. During the experiment which took place when she felt secure, and when sexual topics were discussed, the following occurred (Fig. 21):

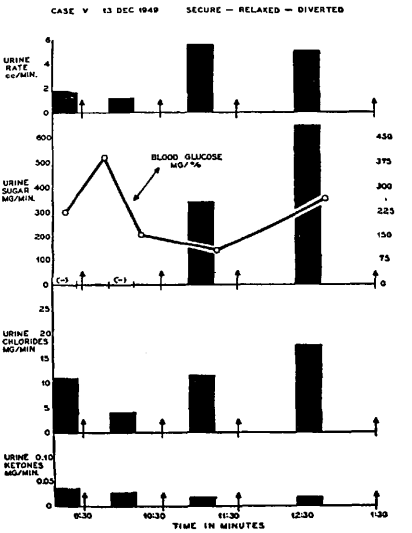

Fig. 21—Case V. Changes in urine output produced by ingesting 500 cc. of 50 per cent glucose solution on a day when patient felt relatively secure, cared for, and happy, and when topics usually associated with hypoglycemia were discussed.

1. Her rate of urine formation rose to 5.5 cc./min., with a total output of 812 cc. during the observation period.

2. The rate of glucose excretion rose to 645 mg. per minute in the fourth sample. Total glucose output during the observation period was 73.1 Gm. The concentration of glucose in the fourth specimen was 12.8 per cent. When glucose appeared in her urine during this experiment, it was in high concentration relative to the volume of urine.

3. The rate of chloride output rose from 4.1 mg./min. in the second specimen to 17.5 mg./min. in the fourth; the chloride concentration in these specimens was 3.4 mg./cc., and in the third specimen was 2.2 mg./cc. Total chloride loss during the procedure was 2.265 Gm., expressed as NaCl.

4. The rate of ketone output was 0.034 to 0.017 mg./min. throughout—which is the same as that found in nondiabetic subjects under similar circumstances.

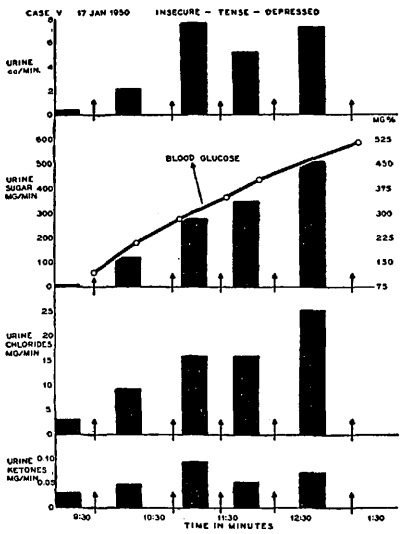

Fig. 22—Case V. Changes in urinary output produced by ingesting 500 cc. of 50 per cent glucose solution on a day when patient felt unloved, insecure, resentful and depressed, and when the investigator assumed a cold and inattentive attitude toward her.

By contrast, the following changes took place in her urinary constituents during the experiment associated with hostility (Fig. 22):

1. Her urine output rose to 7.7 cc./min., with a total output of 1130 cc. during the observation period, after glucose was given. She lost 39 per cent more water during this time than she did during the first procedure.

2. Her rate of glucose excretion rose to 511 mg./min. in the fourth sample. The total glucose output during the observation period after glucose was given was 66.7 Gm. This is approximately the same amount as she excreted during the first experiment (6.4 Gm. less). The concentration of glucose in the fourth specimen was 7.08 per cent. In this experiment she lost much more water in excreting the same amout of glucose.

3. The rate of chloride excretion rose to 25.2 mg./min. in the fourth sample; the chloride concentration in this sample was 3.4 mg./cc. Total chloride loss during the procedure was 3.555 Gm., which is 57 per cent more than she lost in the same period of time during the first experiment.

4. The rate of ketone output was 0.093 to 0.046 mg./min., which is not significantly different from that in the first experiment.

Comment: These two experiments illustrate many of the changes in glucose, ketone, water, and electrolyte metabolism which we have found to accompany changes in life situation, attitudes and feelings in many other experimental studies (10–13). They may be summarized thus:

1. Accompanying changes in life situations, there may be pronounced changes in the glucose tolerance curve, and apparently in the rate of uptake of glucose by the tissues. Large and rapid fluctuations in the level of fasting blood glucose may occur (13).

2. A pronounced ketonemia may be induced by stressful life situations associated with conscious or unconscious feelings of deprivation, accompanied by moods of hostility, dejection, and anxiety. Such a rise in ketonemia is often accompanied by a fall in blood glucose in the fasting individual (10).

3. During stressful life situations the level of circulating eosinophiles may fall rapidly, apparently indicating a discharge of 11-17 oxysteroids from the adrenal cortex (12).

4. A pronounced diuresis of water and chlorides may be produced in both nondiabetic and diabetic subjects under stress. If glycosuria is present the rate of output of glucose goes up roughly parallel to the rate of water output (11).

5. The glycosuria of diabetics under stress is accompanied by a large loss of chloride and water; but the glycosuria of a diabetic person not under stress may be associated with very little loss of chloride or water (11).

6. The increased glycosuria which occurs in diabetics under stress is not associated with a further elevation of blood glucose. When a diabetic person in the *post-absorptive state* is subjected to situational stress his blood glucose usually falls, while fluctuating widely. The rise in urine output and glucose excretion which occurs at the same time appears to be the result of physiologic changes in the kidney which lead to a generalized diminution in tubular reabsorption. This polyuria of stress occurs in both diabetic and non-

diabetic persons, and takes place regardless of whether or not glucose is present in the urine. Although glycosuria is usually not present unless the blood sugar is somewhat elevated, the rise in glucose excretion which occurs in parallel with the rise in urine volume during stress, is *not* caused by a further rise in the blood sugar. Neither is it caused by a rise in the blood ketones, for it may take place in the absence of such a rise. The level of blood glucose at which glycosuria appears also may change markedly with changes in the subject's life situation and his reaction to it (11).

Incidentally, Mirsky (21) has emphasized that the ingestion of very large amounts of glucose does not cause an elevation of the level of the ketones in either the blood or the urine of a diabetic.

Subsequent Course of this Patient: The patient developed insight into the situations and attitudes associated with the changes in her illness. She learned to take added insulin, salt, and glucose when changes in her life situation demanded them, and thereby cut down the severity of her symptoms. Because she felt that despite his defects her husband was still her chief source of affection and security, and because she felt real loyalty and affection for her children, she decided that she must make no move to break up her marriage. In this decision she was supported by the physician. The rapid fluctuations in her diabetes have continued as they were before therapy. Sodium diphenyl hydantoinate, 0.1 Gm. q.i.d. (her limit of tolerance for it) had no demonstrable effect upon the fluctuations of her diabetes. Her physical status is unchanged.

Discussion

These 3 cases were selected for presentation because they illustrate well many of the characteristics of the group of 50 from which they were chosen. Observations on 3 adult, mild diabetics will be presented in similar detail in another paper, in order that they may be carefully compared with these. With full awareness of the fact that generalizations concerning all cases of diabetes cannot be drawn from a study of 3 cases, we believe it is of interest to examine some of the common characteristics of those which have been described.

It is striking that in each of them the onset of the disease occurred at a time of serious life stress, and that the exacerbations correlated similarly with life stresses. It is difficult to say just when diabetes "begins," for the syndrome can be detected in its earliest stages only by means of chemical tests which are not likely to be done upon persons who are apparently well. Nevertheless, it is known that the clinical course of the disorder often begins with weight gain, leading to a period of obesity of months or years; and that this is followed by a period of weight loss associated with polyuria and thirst. In some cases, as in Case V, the preliminary period of obesity may be absent. Accepting these two stages as the best criteria we have for the clinical onset of the disorder, it is apparent that in these three cases the development of each of the phases coincided with a significantly stressful life situation. The fact that the stress occurred around the time of puberty in Cases Z and U, and after childbirth in Case V, may have been of importance also. These are periods of increased pituitary activity and changing hormonal patterns, when presumably an added stress might more easily lead to a disorganization of metabolic adaptive responses. In any case, it seems likely that the life stress may have been one of the factors which precipitated the onset of the disorder; the fact that a similar correlation of life stress with onset has been found in almost all members of the group of 50 strengthens this supposition.

On the other hand, there is no reason to believe that the life situations through which these people passed were *in themselves* the cause of the diabetes. It is quite obvious that they differ neither by nature nor by degree from the types of stress which many individuals encounter at some time during life without developing diabetes. It seems likely that the early training of these persons and perhaps certain consitutional factors may have made the stresses in question peculiarly meaningful for them. Most investigators are agreed that in the pathogenesis of diabetes certain constitutional or stock factors are of leading importance. Just how important such factors may be cannot be determined from a study such as this.

The fact that ketosis occurs in association with life stress, and that such stress can be shown to produce an increase in ketonemia and urine output in the absence of changes in diet, insulin, or activity should not be interpreted as meaning that changes in diet, insulin, and activity do not usually occur at such times. Patients usually react to stressful life situations with alterations of their total behavior. In addition to the direct metabolic changes which take place it is quite customary for them to alter their eating habits, neglect to sterilize their equipment, and take their insulin irregularly, partially, or not at all, during stressful episodes. All of these factors work together to cause ketosis and coma. Since they are all different aspects of the total reaction to stress, it is unprofitable to try to separate them in practice, or to split hairs about which is the most important single factor in all cases.

In nearly all of the subjects of this study there has seemed to be an intense underlying need for love and attention directed primarily toward the mother,

present even from their earliest childhood and never fulfilled to the patient's satisfaction. "Mother never gave me as much love as I needed" is a typical statement. In the women it appears that this failure of fullfillment arose from the cold, undemonstrative, or rejecting attitude of the mother toward the child. In the men it appears that the failure arose from the presence of a hostile, punitive, dominating male parent, fear of whom thwarted or interfered with the close relationship with the mother which the child desired. In nearly all of our patients there was likewise an early and intense desire for food, and especially carbohydrate food. Many of the patients had early experiences which strongly conditioned the relationship between food and parental love and approval, over and above the strong conditioning of this relationship which apparently results in every human from the early nursing experience. Note for example how the mothers of patients U and V were cold and disapproving, rewarding good behavior only with special food and clothing, and how the father of patient Z constantly belittled him, but on rare occasions brought him candy.

Other aspects of the personality development seem to flow from these basic factors. In all of the patients there was a close and continuing relation with the mother, with strong dependence upon her during adult life. In the girls this dependence was mingled with an intense resentment toward her because of her dominating, punitive, and rejecting nature. In adulthood they seemed unable to relate securely to men because of their insecurity with regard to mother. This may have been the genesis of the homosexuality in some of them. In the men, conflict with male parent figures remained a problem throughout life. Under circumstances in which there was a real or symbolic deprivation of mother love an intense craving for food arose in both men and women. In both sexes repeated or sustained deprivations of this sort were accompanied by obesity, and later by the onset of diabetes. Thus we have seen diabetes beginning after separation from the mother, after her death, and after the loss of friends, money, social position, or parental approval —in each case the loss apparently being reacted to by the patient as if it were the loss of a significant source of love, attention, and security.

Attempts to regulate the diets of such persons and to deprive them of part of their usual food would be fruitless because such attempts are opposed by strong psychologic drives. These patients, as well as a large number of the others whom we have seen, were unable to follow the usual diabetic diets for more than a few months. Caught between their strong desire for food and the restriction of their diets, they soon began to eat furtively, concealing their total intake even from themselves. Attempts to enforce diets by "detective" methods merely led to more concealment, more friction between parent and child, and more guilt, anxiety, and conflict in the patients. Bruch (23) has dealt with this aspect of juvenile diabetes at length. It is our impression that the argument between the proponents of restrictive and free diets is largely academic. By far the greater number of the patients whom we have seen who were said to be following diets had actual food intakes widely at variance with the dietary prescription. In effect, most patients seem to be on a free diet, regardless of what their physicians believe they are eating.

In view of this tendency of the patients to react to significant stresses as if they were deprivations, and in view of their aparent unconscious or conditioned identification of "food" with "love and security," it is interesting to note that metabolism of diabetes appears to have all of the qualitative aspects of the reaction of nondiabetic persons to total starvation. In a starved man the respiratory quotient falls toward 0.7, and metabolic processes are largely sustained by fat. Ketonemia appears, and rapidly rises to high levels (8). There may be a moderate diuresis at the onset of the starvation also (14). Furthermore, if glucose is fed to a starving individual, it rises to high and sustained levels in his blood (the "tolerance curve is diabetic") and appears in his urine; the R. Q. does not rise, the intermediary products of glucose metabolism do not appear in the blood, and the serum inorganic phosphate does not fall (27). All of this suggests that the glucose is not taken up by the tissues. All of these responses are characteristic of the diabetic without insulin, as illustrated by the second experiment on Case V (Fig. 20). The only demonstrated metabolic difference between this "starvation diabetes" and diabetes mellitus is the fact that the former disappears within a few hours after the ingestion of food. Because of this similartiy of response between the diabetic and the starved man, we have developed a working concept of persons with diabetes mellitus as persons who react to significant life stresses as if they were deprivations of food, and respond inappropriately with a metabolic response which is appropriate to starvation.

Although our data were not gathered by an exclusively free associative technic, it is perhaps significant that our inferences as to the psychodynamic aspects of these cases are quite similar to those previously described in cases which have been

psychoanalyzed. Daniels (5), in 1936, and Dunbar (6), in 1943, reported the analysis of cases which were in major respects similar to ours. Meyer, Bollmeier, and Alexander (23), in 1945, described the analysis of two patients, and connected the origin of their disease with a traumatic weaning process. This, they felt, had led to a feeling of being unloved, and a strong need to be cared for associated with hostility toward those who frustrated this need. Mirsky (20), in 1948, developed this concept further by stating that the frustration of the intense infantile desire to be cared for was re-activated by the trauma which initiated the diabetes, and stating further that "Diabetes mellitus in man may result from a relative failure in an individual's attempt to adapt physiologically and psychologically to the stresses of his environment." The fact that our inferences, drawn from a different method of study, are so close to those of these authors, suggests that the passage of time and further investigation may prove this concept to be essentially correct.

Conclusions

The life histories of 3 persons with labile diabetes mellitus have been presented in detail. From long-term observations of their course and short-term experimental studies under controlled conditions, the following conclusions may be drawn:

1. In these cases the onset of the symptoms of diabetes occurred in a setting of significant life stress.

2. Exacerbations of the diabetes, associated with ketosis and coma, very frequently occurred in association with acutely stressful life situations.

3. Remissions of the diabetes, associated with reduced insulin requirements and hypoglycemic reactions, occurred during periods of relative security.

4. Acute peripheral neuritis on one occasion, and generalized edema on another occasion, occurred in one patient in a setting of sustained stress, and disappeared after removal of the stress.

5. In one patient, a fall in insulin requirement from 130 units a day to 40 units a day occurred within seven days after he had been admitted to a hospital ward and removed from a stressful life situation. The insulin requirement rose promptly to 80 units a day when the stressful situation was again introduced while he was still a patient on the ward; and his insulin requirement rose again to 130 units when he left the hospital to return to his former life situation.

6. Overeating was a part of the characteristic response of these patients to stress.

7. Some of the infections which these patients developed were a consequence of their overt behavior in a setting of stress.

8. Thirst, polyuria, dehydration, ketosis, and coma occurred in these patients as a part of their physiologic response to stressful life situations. These changes took place even if no significant change was made in their insulin intake, diet, or activity, and in the absence of infection.

9. Under controlled laboratory conditions, these patients developed immediate increases in ketonemia when presented with stressful situations which aroused significant conflicts in them. This ketonemia subsided when the stress was removed.

10. Under controlled laboratory conditions, these patients developed an increase in urine output, glucose output, and chloride loss, when presented with stressful situations which aroused significant conflicts in them. These effects subsided when the stress was removed.

11. In one patient the tolerance for ingested glucose was characteristically diabetic in a setting of stress, and it was remarkably less diabetic in a setting not interpreted as stressful.

In the discussion of these observations it has been suggested that diabetes mellitus is a disorder of adaptation, and that persons showing this disorder react to various life stresses with a physiologic response which is appropriate to starvation, but inappropriate to the deprivations which they have suffered.

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